

8 the forearm link has a proximal end, a distal end and a
9 forearm axis extending longitudinally from the proximal end of
10 the forearm link to the distal end of the forearm link;

11 the wrist link has a proximal end and a distal end and
12 a wrist axis extending from the proximal end of the wrist link
13 [forearm] to the distal end of the wrist link [forearm];

14 the proximal end of the forearm link is connected to
15 the control section, the distal end of the forearm link is
16 connected to a pivotal wrist joint; and

17 the proximal end of the wrist link is connected to the
18 pivotal wrist joint and the distal end of the wrist link is
19 connected to the end effector;

20 and the control section comprises a plurality of
21 control motors and linkages [adapted] to operate the insertion
22 section with at least five degrees of freedom including:

23 insertion and retraction of the forearm link along the
24 forearm axis and through the small incision;

25 rotation of the forearm link about the forearm axis;

26 pivotal motion of the forearm link about a first
27 pivotal axis and a second pivotal axis which are perpendicular to
28 each other and intersect the forearm axis at a pivot point
29 between the proximal end of the forearm link and the distal end
30 of the forearm link adjacent the small incision, wherein such
31 pivotal motion of the forearm link avoids lateral movement of the
32 forearm link at the pivot point; and

33 pivotal motion of the wrist link relative to the
34 forearm link.

2.

27. (Amended) The endoscopic surgical instrument as
described in claim 26 wherein the wrist link comprises an inner
link and an outer link and wherein the control section operates
[is adapted to operate] the insertion section with at least six
degrees of freedom including movement of the outer link of the
wrist link relative to the inner link of the wrist link.

3.

28. (Amended) The endoscopic surgical instrument as
described in claim 27 wherein the outer link of the wrist link

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3 and the inner link of the wrist link are axially aligned and
4 wherein the control section rotates [is adapted to rotate] the
5 outer link relative to the inner link.

4.

1 ~~29~~ (Amended) The endoscopic surgical instrument as
2 described in claim ~~26~~ wherein the end effector comprises a first
3 element and a second element and wherein the control section
4 moves [is further adapted to move] the first element relative to
5 the second element.

5.

1 ~~30~~ (Amended) The endoscopic surgical instrument as
2 described in claim ~~27~~ wherein the end effector comprises a first
3 element and a second element and wherein the control section
4 moves [is further adapted to move] the first element relative to
5 the second element.

6.

1 ~~31~~ (Amended) The endoscopic surgical instrument as
2 described in claim ~~26~~ wherein the end effector comprises a
3 surgical instrument head selected from the group of retractors,
4 electrosurgical cutters, electrosurgical coagulators, forceps,
5 needle holders, scissors, blades and irrigators.

7.

1 ~~32~~ (Amended) The endoscopic surgical instrument as
2 described in claim ~~26~~ wherein the control section is [adapted to
3 be] fixed to a support rail of a surgical table for support of
4 ¹the surgical manipulator during surgery.

8.

1 ~~33~~ (Amended) A surgical method for endoscopic
2 surgery comprising the steps of:

3 providing an endoscopic surgical instrument comprising
4 a control section and an insertion section; [wherein:]

5 inserting the insertion section [is adapted to be
6 inserted] into a patient through a small incision to a location
7 adjacent a worksite inside the patient, wherein [;] the insertion
8 section comprises a rigid forearm link, a wrist link and an end
9 effector, and wherein:

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10 the forearm link has a proximal end, a distal end and a
11 forearm axis extending longitudinally from the proximal end of
12 the forearm link to the distal end of the forearm link;

13 the wrist link has a proximal end and a distal end and
14 a wrist axis extending from the proximal end of the wrist link
15 [forearm] to the distal end of the wrist link [forearm];

16 the proximal end of the forearm link is connected to
17 the control section, the distal end of the forearm link is
18 connected to a pivotal wrist joint; [and]

19 the proximal end of the wrist link is connected to the
20 pivotal wrist joint and the distal end of the wrist joint is
21 connected to the end effector; and [inserting] the forearm link
22 is inserted distally along the forearm axis through the small
23 incision;

24 operating a servomechanism to rotate the forearm link
25 about the forearm axis;

26 operating the [a] servomechanism to pivot the forearm
27 link about a first pivotal axis and a second pivotal axis which
28 are perpendicular to each other and intersect the forearm axis at
29 a pivot point, the pivot point disposed between the proximal end
30 of the forearm link and the distal end of the forearm link and
31 adjacent the small incision, wherein such pivotal operation of
32 the forearm link avoids lateral movement of the forearm link at
33 the pivot point;

34 operating the [a] servomechanism to pivot the wrist
35 link relative to the forearm; and

36 manipulating human tissue with the end effector at the
37 worksites inside the patient[;

38 and operating a servomechanism to retract the forearm
39 link along the forearm axis through the small incision].

1 9. 34. (Amended) The method as described in claim 33
2 wherein:

3 the endoscopic surgical instrument providing step [of
4 providing a surgical manipulator] comprises providing a surgical
5 manipulator with a wrist link which comprises an inner link and
6 an outer link; and

7 the method comprises the additional step of operating
8 the [a] servomechanism to move the outer link of the wrist link
9 relative to the inner link of the wrist link.

10 11. 35 (Amended) The method as described in claim 34
12 wherein:

13 the surgical manipulator providing step [of providing a
14 surgical manipulator] comprises axially aligning [providing a
15 surgical manipulator wherein] the outer link of the wrist link
16 and the inner link of the wrist link [are axially aligned]; and

17 the step of moving the outer link of the wrist link
18 relative to the inner link of the wrist link comprises the step
19 of operating the [a] servomechanism to rotate the outer link
20 relative to the inner link.

21 12. 36 (Amended) The method as described in claim 33
22 wherein:

23 the [step of providing a surgical manipulator comprises
24 providing a surgical manipulator wherein the] end effector
25 comprises a surgical instrument having a first element and a
26 second element; and

27 the method comprises the additional step of operating
28 the [a] servomechanism to move the first element relative to the
29 second element.

30 13. 37 (Amended) The method as described in claim 34
31 wherein:

32 the [step of providing a surgical manipulator comprises
33 providing a surgical manipulator wherein the] end effector
34 comprises a surgical instrument having a first element and a
35 second element; and

36 the method comprises the additional step of operating
37 the [a] servomechanism to move the first element relative to the
38 second element.

39 14. 38 (Amended) The surgical method as described in
40 claim 34 wherein:

3 the [step of providing a surgical manipulator comprises
4 providing a surgical manipulator wherein the] end effector
5 comprises a surgical instrument head selected from the group
6 consisting of retractors, electrosurgical cutters,
7 electrosurgical coagulators, forceps, needle holders, scissors,
8 blades and irrigators; and

9 the step of manipulating human tissue comprises the
10 step of actuating the surgical instrument head.

1 14. ^{14.} ~~39.~~ (As Filed) The surgical method as described in claim ¹⁸ ~~38~~
2 further comprising the step of mounting the control section on a support rail
3 of a surgical table for support of ^a the surgical manipulator during surgery.

1 15. ^{15.} ~~40.~~ (Amended) An endoscopic surgical instrument
2 comprising an insertion section and a control section wherein:

3 the insertion section is insertable [adapted to be
4 inserted] into a patient through a small incision to a location
5 adjacent a worksite in the patient;

6 the insertion section comprises a rigid forearm link, a
7 wrist link and an end effector wherein:

8 the forearm link has a proximal end, a distal end and a
9 forearm axis extending longitudinally from the proximal end of
10 the forearm to the distal end of the forearm;

11 the wrist link has a proximal end and a distal end and
12 a wrist axis extending from the proximal end of the forearm to
13 the distal end of the forearm;

14 the proximal end of the forearm link is connected to
15 the control section, the distal end of the forearm link is
16 connected to a pivotal wrist joint; and

17 the proximal end of the wrist link is connected to the
18 pivotal wrist joint and the distal end of the wrist joint is
19 connected to the end effector;

20 and the control section comprises:

21 means for inserting and retracting the forearm link
22 along the forearm axis and through the small incision;

23 means for rotating the forearm link about the forearm
24 axis;

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25 means for pivoting the forearm link about a first
26 pivotal axis and a second pivotal axis which are perpendicular to
27 each other and intersect the forearm axis at a pivot point
28 between the proximal end of the forearm link and the distal end
29 of the forearm link adjacent the small incision, wherein such
30 pivotal means avoids lateral movement of the forearm link at the
31 pivot point; and

32 means for pivoting the wrist link relative to the
33 forearm link so as to control the angle between the forearm axis
34 and the wrist axis.

1 16.
2 41. (Amended) The endoscopic surgical instrument
3 [surgical manipulator] as described in claim 40 wherein the wrist
4 link comprises an inner link and an outer link and wherein the
5 control section further comprises means for moving the outer link
 of the wrist link relative to the inner link of the wrist link.

1 17.
2 42. (Amended) The endoscopic surgical instrument
3 [surgical manipulator] as described in claim 41 wherein the outer
4 link of the wrist link and the inner link of the wrist link are
5 axially aligned and wherein the control section further comprises
 means for rotating the outer link relative to the inner link.

1 18.
2 43. (Amended) The endoscopic surgical instrument
3 [surgical manipulator] as described in claim 40 wherein the end
4 effector comprises a first element and a second element and
5 wherein the control section further comprises means for moving
 the first element relative to the second element.

1 19.
2 44. (Amended) The endoscopic surgical instrument
3 [surgical manipulator] as described in claim 41 wherein the end
4 effector comprises a first element and a second element and
5 wherein the control section further comprises means for moving
 the first element relative to the second element.

1 20.
2 45. (Amended) The endoscopic surgical instrument
3 [surgical manipulator] as described in claim 42 wherein the end

3 effector comprising a surgical instrument head selected from the
4 group of retractors, electrosurgical cutters, electrosurgical
5 coagulators, forceps, needle holders, scissors, blades and
6 irrigators.

1 ^{21.}
2 ~~46.~~ (Amended) The endoscopic surgical instrument
3 [surgical manipulator] as described in claim ~~42~~¹¹ wherein the
4 control section further comprises means for mounting the control
5 section on a support rail of a surgical table for supporting the
6 endoscopic surgical instrument [surgical manipulator] during a
surgical procedure.

Please add claims 47-57 as follows:

1 ^{22.}
2 ~~47.~~ A minimally invasive surgery system comprising:
3 a surgical station including a manipulator linkage
4 supporting an actuatable end effector, the manipulator including
5 an elongate rigid member having a proximal end and a distal end,
6 wherein a joint is disposed between the distal end of the member
and the end effector;
7 a control station including an actuatable handle and a
8 movable controller; and
9 a servomechanism coupling the handle to the end
effector so that actuation of the handle effects actuation of the
end effector to manipulate tissue at an internal surgical site
within a patient body, wherein the servomechanism moves the end
effector within the internal surgical site in response to
movement of the controller by pivoting the member about an
insertion point between the proximal and distal ends of the
member, wherein such pivotal movement of the member avoids
lateral movement of the member at the insertion point, and by
articulating the joint distally of the insertion point and within
the patient body.

1 ^{23.}
2 ~~48.~~ The minimally invasive surgery system of claim ~~47~~²²
3 wherein the member comprises a rigid forearm link defining a
forearm axis extending longitudinally from the proximal end of

4 the forearm to the distal end of the forearm, and further
5 comprising:

6 a wrist link pivotally connected to the distal end of
7 the forearm so as to pivot about a first axis which is generally
8 perpendicular to the longitudinal forearm axis of the forearm
9 link;

10 wherein the end effector comprises an end effector
11 member coupled to the wrist link by the joint so as to move about
12 a second axis which is generally perpendicular to the first axis.

24. 1 49. The minimally invasive surgery system of Claim 48,
2 wherein said end effector includes a pair of jaw elements
3 pivotally coupled to the wrist link. 23

25. 1 50. The minimally invasive surgery system of claim 47,
2 wherein the servomechanism drives the proximal end of the member
3 laterally relative to an axis of the member in first and second
4 degrees of freedom, and wherein the servomechanism drives the
5 proximal end of the member axially relative to the axis in a
6 third degree of freedom in response to movement of the
7 controller. 22

26. 1 51. The minimally invasive surgery system of claim 50,
2 wherein the servomechanism pivots the end effector so as to
3 orient the end effector within the patient body with a plurality
4 of degrees of freedom relative to the member. 25

27. 1 52. The minimally invasive surgery system of claim 47,
2 wherein the ^{Control} controller station includes a station housing,
3 wherein the controller comprises a linkage coupling the handle to
4 the station housing, wherein the servomechanism repositions the
5 end effector in the internal surgical site in response to
6 repositioning of the handle in a station workspace, and wherein
7 the servomechanism reorients the end effector in the internal
8 surgical site in response to reorientation of the handle in the
9 station workspace. 22

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1 53. The minimally invasive surgery system of claim 58,
2 wherein the surgical station includes an endoscope oriented
3 toward the end effector, wherein the control station includes a
4 display coupled to the endoscope so as to produce an image of the
5 end effector, and wherein the display is oriented relative to the
6 handle and the servomechanism is programmed so that the image of
7 the endoscope as viewed by an operator and the handle as held by
8 a hand of the operator appear to the operator to define an
9 integral body during positional and orientational movements of
10 the handle and the end effector.

29.

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1 54. The minimally invasive surgery system of claim 47,
2 wherein the end effector comprises a surgical instrument head
3 selected from the group consisting of retractors, electrosurgical
4 cutters, electrosurgical coagulators, forceps, needle holders,
5 scissors, blades, and irrigators.

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1 A minimally invasive surgery system comprising:
2 a surgical station including a manipulator linkage
3 supporting an end effector so that the end effector can move in
4 three dimensions, the manipulator including an elongate rigid
5 member having a proximal end and a distal end, the proximal end
6 of the member movable in a plurality of proximal degrees of
7 freedom, wherein a joint is disposed between the distal end of
8 the member and the end effector, the joint providing a plurality
9 of distal degrees of freedom;

and a movable controller

10 a control station including an actuatable handle, the
11 actuatable handle movable in a three dimensional station
12 workspace; and

13 a servomechanism coupling the handle to the end
14 effector so that actuation of the handle effects actuation of the
15 end effector, the servomechanism coupled to the manipulator so
16 that movement of the controller in the three dimensional space
17 effects movement of the end effector in the surgical site by
18 driving the proximal end in the proximal degrees of freedom, by
19 pivoting the member about an insertion point between the proximal
20 end and the distal end, wherein such pivotal movement of the

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21 member avoids lateral movement of the member at the insertion
22 point, and by articulating the joint about the distal degrees of
23 freedom.

31.

56. A minimally invasive surgery method comprising:
1 inserting a surgical end effector into an internal
2 surgical site of a patient body through a percutaneous
3 penetration, the end effector attached to a rigid member by a
4 joint;
5 actuating the end effector to manipulate tissue in
6 response to actuation of a handle of a control station;
7 moving the end effector at the surgical site with a
8 servomechanism in response to movement of the handle by driving a
9 proximal end of the member outside the patient body with the
10 servomechanism and by articulating the joint inside the patient
11 body with the servomechanism, wherein the member pivots about the
12 percutaneous penetration between the proximal end of the member
13 and a distal end of the member when the end effector is moved by
14 the servomechanism so as to avoid lateral movement of the member
15 relative to the percutaneous penetration.

32.

57. The minimally invasive surgery method of claim 56,
1 wherein the member comprises a rigid forearm, wherein a wrist
2 member is pivotally connected to the forearm member by the joint
3 so as to pivot about a first axis, and wherein the end effector
4 comprises a plurality of end effector elements movably coupled to
5 the wrist member so as to move about a second axis that is
6 generally perpendicular to the first axis;

7 wherein the moving step is performed by manually
8 pivoting a wrist-pivoting element of a control assembly to cause
9 the wrist member to pivot correspondingly about the distal
10 forearm end and along the first axis; and

11 wherein the end effector actuation step is performed by
12 manually actuating the handle to cause the end effector elements
13 to move about the second axis.

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